PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 17 November 2000 (17.11.00)	
International application No. PCT/DK00/00132	**Applicant's or agent's file reference** P199900239WO
International filing date (day/month/year) 21 March 2000 (21.03.00)	**Priority date** (day/month/year) 22 March 1999 (22.03.99)
Applicant BRUUN FAMME, Per	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

19 October 2000 (19.10.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

R. E. Stoffel

Telephone No.: (41-22) 338.83.38

,TENT COOPERATION TRE.. Y

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

HOFMAN-BANG A/S
Hans Bekkevolds Allé 7
DK-2900 Hellerup
DANEMARK

Date of mailing (day/month/year)
01 October 2001 (01.10.01)

Applicant's or agent's file reference
P199900239WO

IMPORTANT NOTIFICATION

International application No.
PCT/DK00/00132

International filing date (day/month/year)
21 March 2000 (21.03.00)

1. The following indications appeared on record concerning:

[X] the applicant [X] the inventor [ ] the agent [ ] the common representative

Name and Address
BRUUN FAMME, Per
Turkisvej 6B
DK-5210 Odense NV.
Denmark

State of Nationality: DK
State of Residence: DK
Telephone No.:
Facsimile No.:
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [ ] the name [X] the address [ ] the nationality [ ] the residence

Name and Address
BRUUN FAMME, Per
Hunderupvej 28
DK-5000 Odense C
Denmark

State of Nationality: DK
State of Residence: DK
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

Authorized officer
Athina NICKITAS-ETIENNE
Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
P199900239WO		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/DK00/00132	21/03/2000	22/03/1999
International Patent Classification (IPC) or national classification and IPC G01M3/28		
Applicant APV HEAT EXCHANGER A/S		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 8 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☒ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
19/10/2000	04.07.01
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Neumann, F Telephone No. +49 89 2399 2621

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/DK00/00132

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-11	as originally filed				

Claims, No.:

1-9	as received on	04/04/2001	with letter of	02/04/2001	

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   - ☐ the description, pages:
   - ☐ the claims, Nos.:
   - ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-9
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-9
Industrial applicability (IA)	Yes:	Claims	1-9
	No:	Claims	

2. Citations and explanations
see separate sheet

VI. Certain documents cited

1. Certain published documents (Rule 70.10)

and / or

2. Non-written disclosures (Rule 70.9)

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:
   D2: US-A-5 170 840,
   D3: US-A-5 759 857.

2. The present application does not satisfy the criterion set forth in Article 33(3) PCT because the subject matter of claims 1 to 9 does not involve an inventive step. The reasons are given as follows:

2.1 The feature "in which method for leakage control the differential pressure between the primary and secondary sides is close to or identical with the differential pressures prevailing during actual operation of the heat exchanger" does not serve to distinguish claim 1 over the disclosure of D3. It is clear that the inclusion of this feature is intended to define that the method for leakage control of claim 1 of the present application is carried out as a special test procedure, and is not carried out during normal operation. However, it is noted that this additional feature merely defines that the differential pressure between the primary and secondary sides is identical to the differential pressure prevailing during actual operation: no indication is given that this refers to a special test procedure - the only restriction is that the differential pressures must be identical to those prevailing during actual operation. Since this condition is met during normal operation of the heat exchanger, claim 1 can be interpreted to mean that the method for leakage control is carried out during the actual operation cycle.

2.2 The objections of section VIII, paragraph 1.1 should be noted. The assessment of inventive step has been carried out using the interpretation that the "clear liquid that is recycled" is in fact the product - i.e. the liquid which is passed through the product stream during normal operation of the heat exchanger is a recycled liquid.

The prior art portion of D3 describes a method of leakage control using a highly coloured dye (col. 2, lines 40-57). In particular, a method suitable for leakage

control of the internal faces that separate the primary and secondary sides of a plate heat exchanger is described (see col. 2, lines 40-45) wherein a leakage control is performed in a first step wherein a colorant-containing liquid is supplied to one of the primary and secondary sides (col. 2, line 47) while a clear liquid is supplied to the opposite side (derivable from col. 2, lines 52-53, 56-57), whereby the presence of leakages in the heat exchanger is verified by detection of the presence of the colorant in the clear liquid (see col. 2, lines 52-55). In the method for leakage control, the differential pressure between the primary and secondary sides is identical to the differential pressure prevailing during actual operation of the heat exchanger (since it is carried out during normal operating conditions - see col. 2, lines 55-57).
The type of liquid passed through the product stream of D3 depends merely on the type of product being subjected to heat exchange. In accordance with circumstances the skilled person would pass a **recycled** liquid through the heat exchanger, without the use of an inventive step.
The subject matter of claim 1 therefore lacks an inventive step.

2.3 As shown above, the leakage test of claim 1 may be carried out during normal operation of the heat exchanger. In this case, the subject matter of claims 4 and 5 is also known from the above-cited passage of D3. These claims 5 therefore also lack an inventive step.

2.4 Furthermore, D2 discloses a method of localization of leakages between the primary and secondary sides of a heat exchanger (see col. 1, lines 44-50). As noted in col. 1, lines 6-14 of D2, the "tubing" type heat exchanger referred to therein can be comprised of confronting plates. The method operates by use of a colorant (potassium permanganate) that passes through the leakages and is subsequently detected visually (see col. 2, lines 12-13) wherein a colorant-containing liquid is supplied to the one side of the heat exchanger (see col. 1, line 65 to col. 2, lines 1), and that this side is pressurised (at the pressure of the liquid) for a period of time, while the opposite side is allowed to continue to contain air (see col. 1, lines 62-64: the outer surface of the plate is cleaned and no further liquid is introduced to this volume). The location of the leakages is determined by visual inspection of the plates (see col. 2, lines 1-4).

The disclosure of D2 seems to imply that the visual inspection is carried out during the test procedure: the outer surface of the plate is exposed, the purple tracer is introduced at the inner surface, and the outer surface is observed to see if any seepage occurs. Claim 2 of the present application is distinguished from D2 in that the draining, disassembly and visual inspection of the plate heat exchanger is carried out only after the passage of the colorant-containing liquid.

It does not appear necessary that the inspection of D2 is carried out simultaneously with the passage of colorant-containing fluid; if a leak exists, the purple liquid will be visible on the exterior of the plate even after the test period. D2 clearly indicates that the heat exchanger may be of a plate construction (see col. 1, lines 6-14). Hence, it would appear that it is not impossible to run the test with a disassembled plate heat exchanger. However, if this should prove problematic, then there appears to be no reason why the coloured liquid cannot be passed through the assembled heat exchanger, the heat exchanger being subsequently drained and disassembled for inspection.

Whether the visual inspection occurs during or after the time period in which the coloured liquid is passed through the heat exchanger is considered to be a matter of procedural choice: no inventive step can be acknowledged in the re-organisation of the method steps such that draining, disassembly and visual inspection occur after the liquid has ben passed through.
The subject matter of claim 2 therefore also lacks an inventive step.

2.5 No inventive step can be acknowledged in the desire to simulate operating conditions of the heat exchanger: only in this manner can accurate leakage information be obtained. The subject matter of claim 3 is therefore also lacks an inventive step.

2.6 The subject matter of claims 6-8 is regarded as representing obvious choices for the skilled person, the selection of which is not regarded as comprising an inventive step.

3.6 Claim 9 represents a combination of claims 1 and 2. For the same reasons as given above this claim therefore also lacks an inventive step. No inventive step is

acknowledged in the combination of the two procedures which represents merely a juxtaposition of two independent processes.

Re Item VI
Certain documents cited

1. Certain published documents (Rule 70.10)

Publication number	Publication date	Filing date	Priority date
WO99/19706	22.04.99	08.10.98	10.10.97

Re Item VIII
Certain observations on the international application

1. The application does not meet the requirements of Article 6 PCT because claims 1 and 9 are not clear in the following respects:

1.1 It is not clear, in the context of claim 1, what is meant by "a clear liquid that is recycled". It would appear that the intended meaning is that the clear liquid that circulates on the side opposite to the colorant-containing liquid is used specifically for the test procedure and is recirculated through the heat exchanger during the test process. It would appear from the description that the leakage testing procedure is not carried out when the heat exchanger is under normal operational conditions, but rather that the normal operation is interrupted to enable the test procedure to be carried out. The present wording of claim 1 could be interpreted to mean that the clear liquid passing through the side opposite to the side in which the colorant-containing liquid is passed is a recycled liquid. This does not exclude the possibility that the test procedure is carried out during normal operation of the heat exchanger - i.e. without interruption of the operation - and that the clear liquid is not provided merely for the test, but is one of the normal process fluids passing through the heat exchanger.
Even taking the amendments into consideration, claim 1 does not include an unambiguous definition that the method of leakage control defined therein is

carried out as a separate testing procedure, independently of the normal operation, and that the clear liquid is provided specifically for the test procedure.

Re Item VII
Certain defects in the international application

1. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D2 and D3 is not mentioned in the description, nor are these documents identified therein.

C l a i m s

1. A method for leakage control of the internal faces that separate the primary and secondary sides of a plate heat exchanger, **characterised in** that a colorant-containing liquid is supplied to one of the primary and secondary sides, while a clear liquid that is recycled is supplied to the opposite side, in which method for leakage control the differential pressure between the primary and secondary sides is close to or identical with the differential pressures prevailing during actual operation of the heat exchanger, whereby the presence of leakages in the plate heat exchanger is verified by detection of the presence of the colorant in the clear liquid.

2. A method for localization of leakages between the primary and secondary sides of a plate heat exchanger by use of a colorant that passes through the leakages and is subsequently detected visually, **characterised in** that a colorant-containing liquid is supplied to the one side of the plate heat exchanger, and that this side is pressurised for a period of time, while the opposite side contains air, following which the plate heat exchanger is drained and disassembled, and the location of the leakages is determined by visual inspection of the plates.

3. A method according to claim 2, **characterised in** that the differential pressure between the primary and secondary sides is close to or identical with the differential pressures prevailing during actual operation of the plate heat exchanger.

4. A method according to claim 1 or 2, **characterised in** that the viscosity of the colorant-containing liquid corresponds to the viscosity of the liquid that passes through the corresponding side of the plate heat exchanger in actual operation.

5. A method according to claim 1 or 2, **characterised in** that the passage of the colorant-containing liquid corresponds to the passage on the corresponding side of the plate heat exchanger in actual operation.

6. A method according to claim 1 or 2, **characterised in** that the colorant is a fluorescent substance.

7. A method according to claim 1 or 2, **characterised in that** the detection of the colorant is effected by use of UV-light.

8. A method according to claim 1 or 2, **characterised in** that the colorant is a salt of fluoresceine, preferably the sodium salt uranine thereof.

9. A method for in situ leakage control and localisation of leakages in the internal faces that separate the primary and secondary sides of a plate heat exchanger, **characterised in** that a leakage control is performed in a first step wherein a colorant-containing liquid is supplied to one of the primary and secondary sides, while a clear liquid that is recycled is supplied to the opposite side, in which method for leakage control the differential pressure between the primary and secondary sides is close to or identical with the differential pressures prevailing during actual operation of the heat exchanger, whereby the presence of leakages in the plate

heat exchanger is verified by detection of the presence of the colorant in the clear liquid; and that, in a second step, the presence of leakages entails that the colorant-containing liquid on one side remains pressurised for a period of time, while the opposite side is drained to contain air, following which the plate heat exchanger is drained and disassembled, and the location of the leakages is determined by visual inspection of the plates.

PATENT COOPERATION TREATY

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
P199900239WO		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/DK 00/00132	21/03/2000	22/03/1999
Applicant		
APV HEAT EXCHANGER A/S		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. _____

   [ ] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [X] None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No
PC[redacted]K 00/00132

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01M3/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G01M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 99 19706 A (APV NORTH AMERICA INC) 22 April 1999 (1999-04-22) the whole document	1,2
P,A	---	3-9
X	US 4 328 700 A (FRIES BERNARD A) 11 May 1982 (1982-05-11) summary of invention, figure abstract	1,2
A	---	3-9
X	US 4 688 627 A (GERMAIN JEAN-LUC ET AL) 25 August 1987 (1987-08-25) figures, background and summary of the invention abstract	1,2
A	---	3-9
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 May 2000	20. 07. 00

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Sven-Erik Bergdahl

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PC[redacted]DK 00/00132

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 790 345 A (MANSFIELD G ET AL) 5 February 1974 (1974-02-05) figure abstract	1
A		2-9

X	US 5 170 840 A (GRUNWALD JAMES L) 15 December 1992 (1992-12-15) the whole document	1,6
A		2-5,7-9

X	US 5 759 857 A (GOYAL ET AL) 2 June 1998 (1998-06-02) figure abstract	1
A		2-9

X	EP 0 597 659 A (NALCO CHEMICAL CO) 18 May 1994 (1994-05-18) claims	1
A		2-9

2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PC[redacted]DK 00/00132

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9919706 A	22-04-1999	US 6009745 A	04-01-2000
		AU 9358298 A	03-05-1999
		GB 2335498 A	22-09-1999
US 4328700 A	11-05-1982	JP 53115287 A	07-10-1978
US 4688627 A	25-08-1987	FR 2574545 A	13-06-1986
		DE 3577915 D	28-06-1990
		EP 0184521 A	11-06-1986
US 3790345 A	05-02-1974	DE 2137831 A	03-02-1972
		ES 393711 A	01-06-1974
		FR 2103757 A	14-04-1972
		GB 1327096 A	15-08-1973
		IT 957069 B	10-10-1973
		NL 7110391 A	01-02-1972
US 5170840 A	15-12-1992	NONE	
US 5759857 A	02-06-1998	NONE	
EP 0597659 A	18-05-1994	US 5304800 A	19-04-1994
		AT 166719 T	15-06-1998
		BR 9304674 A	01-11-1994
		CA 2102338 A	11-05-1994
		DE 69318803 D	02-07-1998
		DE 69318803 T	22-10-1998
		ES 2118908 T	01-10-1998
		JP 6281528 A	07-10-1994
		MX 9306984 A	31-01-1995
		US 5416323 A	16-05-1995